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TPC Shorted Ring distortions

view edit outline

Submitted by genevb on Wed, 2007-05-16 11:03.

Reference

Meeting : Software and Computing phone meeting

Speaker : Gene Van Buren (BNL)

Talk time : 12:15, Duration : 00:10

PREFACE

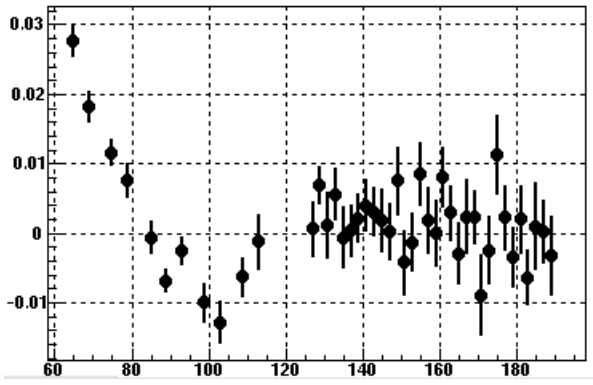
This is a report of the current status of trying to understand the distortions due to the electrical short(s) in the TPC inner field cage east (IFCE) in the current run (for historical info, see here and here). The data on this page comes from the low luminosity fill taken on April 30, 2007 to avoid contributions from the as-yet-uncalibrated luminosity-dependend distortions.

The units on pretty much all plots are [cm].

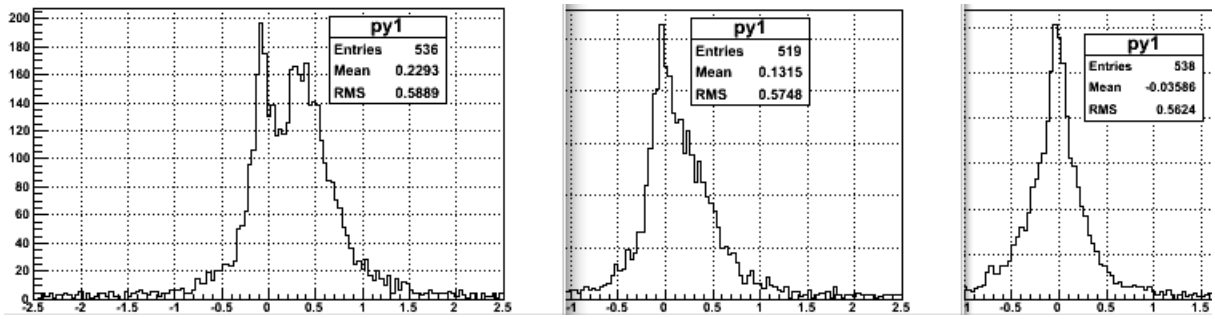
AuAu DATA

The effect of the distortion can be seen by multiple observables. Two such observables are residuals of tracks in the TPC, and the signed DCA (sDCA) of tracks to the primary vertex. We can examine the data without any correction for the distortion, with the correction implied by the current that is measured out of the end of the IFCE resistor chain ("standard correction"), and with some modification to that correction. This data is from physics run 8120057.

TPC residuals vs. radius for no distortion correction (east side, -25cm < z < 0):



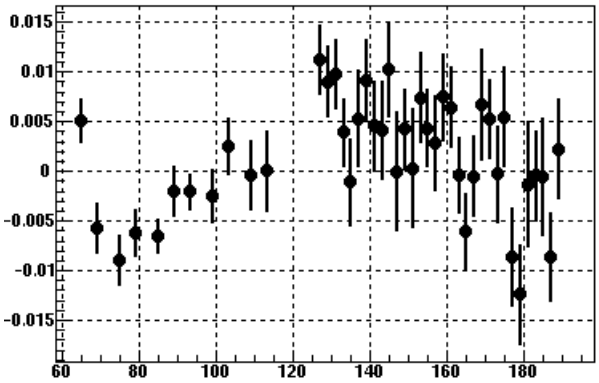
sDCA for no correction, standard correction, standard correction + 0.5MOhm missing resistance:



The bimodality of this data is due to this code allowing for SSD hits on tracks (SVT hits are not allowed, and this is for other reasons for which this histogramming code was previously written). TPC-only tracks produce a broad sDCA peak, while SSD hits cause a much tighter distribution which is much closer to zero; the SSD hits also cause the sDCA to flip sign because the tracks essentially pivot about the SSD point (for more info on this effect, go here).

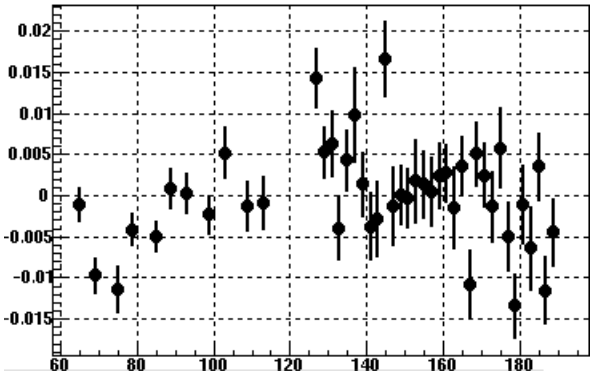
Inexplicably, it appears that I have to add 0.5MOhm missing resistance to the standard correction to get the sDCA to zero.

TPC residuals vs. r (-25cm < z < 0) for standard correction + 0.5MOhm missing resistance:



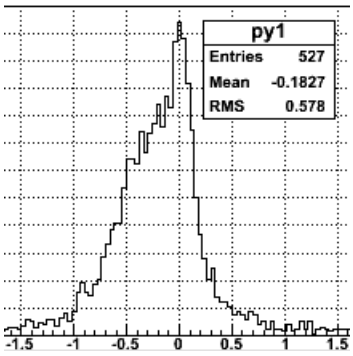
The residuals show that even with 0.5MOhm extra, the distortion in the TPC still does not seem fully corrected. We can approximately correct the residuals using 0.75MOhm extra missing resistance, as shown here:

TPC residuals vs. r (-25cm < z < 0) for standard correction + 0.75MOhm missing resistance:



Unfortunately, doing so causes the sDCA distribution to go past zero, as shown below.

sDCA for tandard correction + 0.75MOhm missing resistance:



Unfortunately, these effects are currently unexplained. Note that the west side of the TPC looks OK (zero) for all sDCAs and residuals.

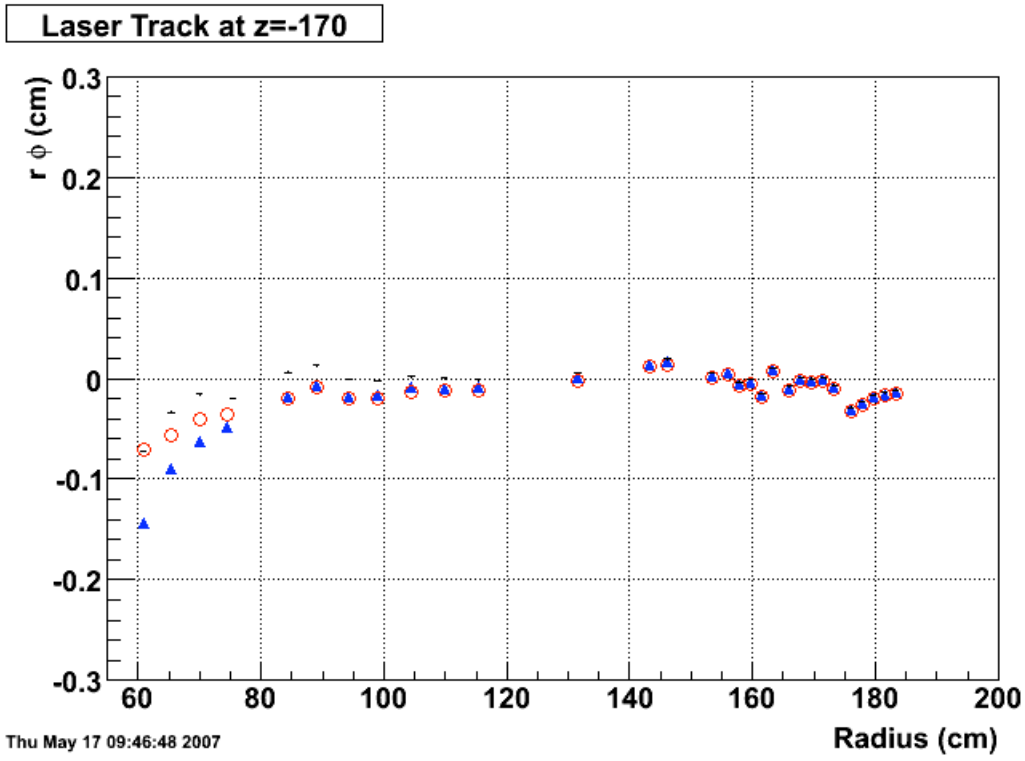
LASER TRACKS

We can look at laser tracks to get out further in z, as the AuAud data is constrained by the +/-30cm online vertex cut. The below plots are similar to ones shown before, where:

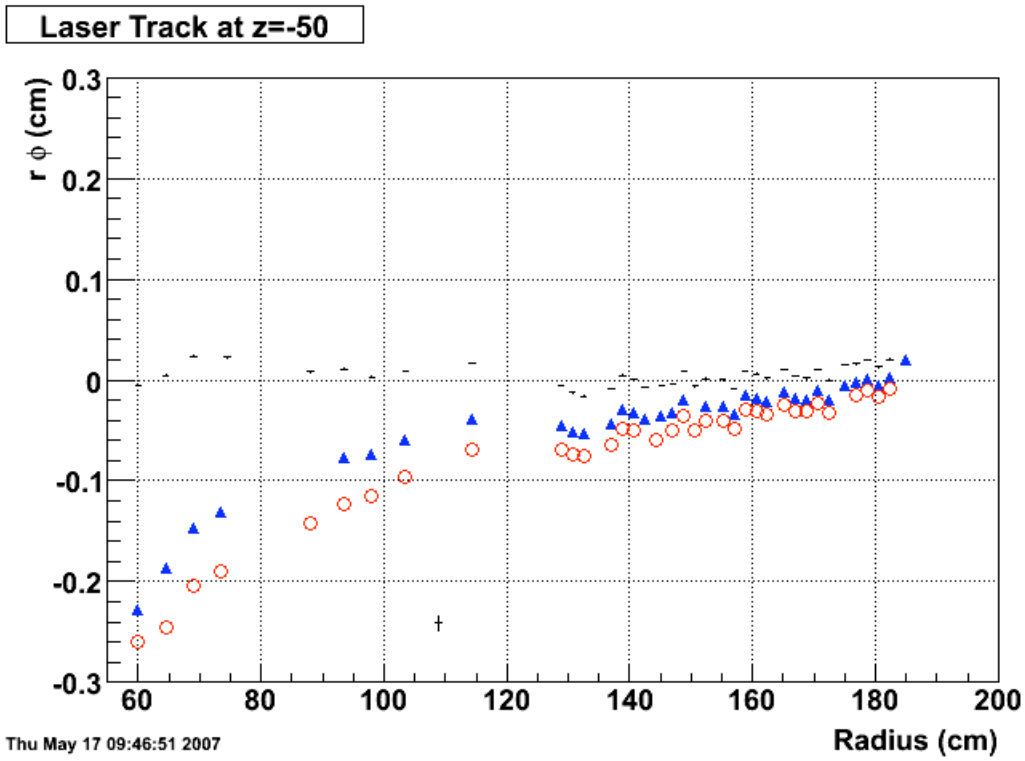
- red circles are the uncorrected data
- blue triangles are using the standard correction
- black crosses are with 0.75MOhms extra.
- the "zero level" is set by a straight line fit to the outer TPC portion of the laser tracks (using the data of the black crosses)

These plots show that at the innermost padrows, even the 0.75MOhms extra is not quite enough to correct the data fully. This data is from laser run 8120056.

Laser at z=-170cm:



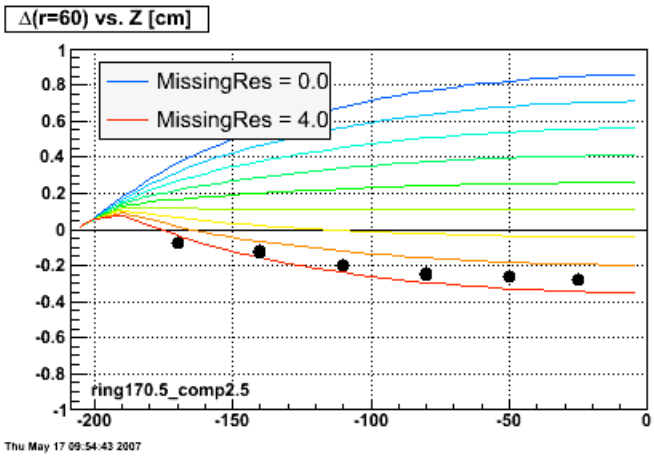
Laser at z=-50cm:



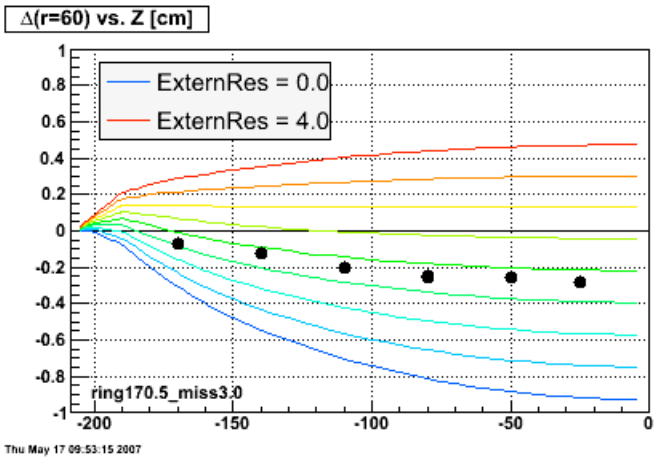
MODEL

Just to show what is being used in these corrections, here are curves of the distortion correction at the first TPC padrow versus z for various parameters. The standard correction for this data would have 2.5MOhms external resistance, and 3.0MOhms missing resistance. The above uncorrected (red circles) laser data (shown as black circles on the below plots) approximately matches curves of 2.5MOhms external & 3.75MOhms missing, or possibly 1.75MOhms external & 3.0MOhms missing. The data available is not very sensitive to whether the missing resistance is internal or external to the TPC.

Models of various missing resistances (external resistance set to known 2.5MOhms):



Models of various external resistances (missing resistance set to standard correction, about 3.0MOhms):



CONCLUSIONS

The distortions in the TPC are consistent with a higher current running through the IFCE resistor chain than we are measuring. The hits from laser tracks and the residuals of TPC hits from physics tracks indicate that this excess current is on par with 0.75MOhms extra missing resistance (either internal or external to the TPC). Even more confusing, the sDCA only needs an excess of 0.5MOhms to appear corrected.

Suggestions are welcome.

Gene Van Buren

(categories:)